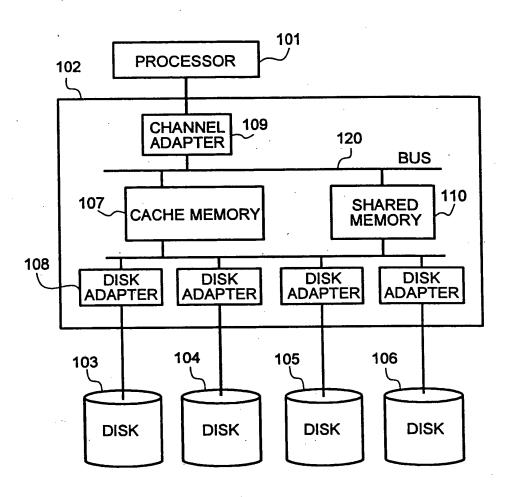Applicant: Kouji ARAI, *et al.*
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FIG.1

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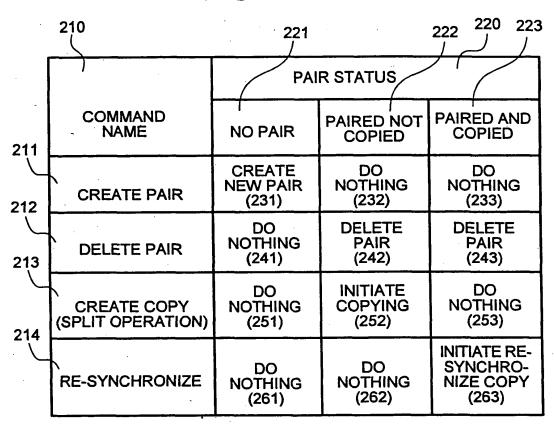Atty Dock t No. 16869P-006210US
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FIG.2

COMMAND NAME (210)	PAIR STATUS (220)		
	NO PAIR (221)	PAIRED NOT COPIED (222)	PAIRED AND COPIED (223)
CREATE PAIR (211)	CREATE NEW PAIR (231)	DO NOTHING (232)	DO NOTHING (233)
DELETE PAIR (212)	DO NOTHING (241)	DELETE PAIR (242)	DELETE PAIR (243)
CREATE COPY (SPLIT OPERATION) (213)	DO NOTHING (251)	INITIATE COPYING (252)	DO NOTHING (253)
RE-SYNCHRONIZE (214)	DO NOTHING (261)	DO NOTHING (262)	INITIATE RE-SYNCHRO-NIZE COPY (263)

FIG.3

PAIR NUMBER (301)	PAIR STATUS (302)	PRIMARY VOLUME (303)	SECONDARY VOLUME (304)	COPY POINTER (305)
1	PAIRED NOT COPIED	12	64	0
:	:	:	:	:

(300)

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FIG.4

TRACK   0123 4567 89AB CDEF

PAIR=0 ————→

PAIR=1 ————→ 0001 0000 0000 1111   401

PAIR=2 ————→ :   :

                   0000 0000 0000 0000

FIG.5

COPY PROCESSING
INPUT = PAIR NUMBER   500

PAIR STATUS FOR THE INPUT PAIR = PAIRED AND COPY IN PROGRESS ?   501   No

Yes

INVOKE COPY PROCESS WITH PAIR # AS INPUT   502

DOES END POINTER = MAXIMUM ADDRESS OF LOGICAL VOLUME (i,e, DONE?)   503   No

Yes

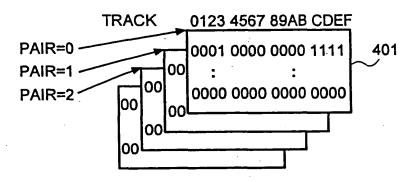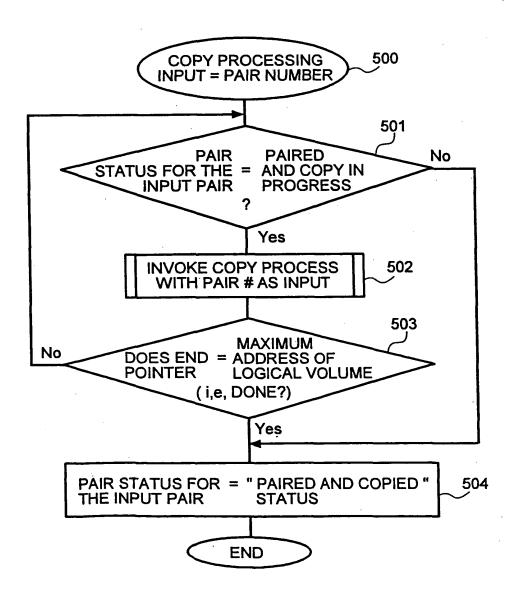PAIR STATUS FOR THE INPUT PAIR = " PAIRED AND COPIED " STATUS   504

END

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FIG.6

ELEMENTAL COPY PROCESSING — 600

FETCH COPY POINTER — 601

SELECT DATA TRACKS HAVING INEQVALITY BIT=1 USING LOCATION INDICATED BT COPY POINTER — 602

READ DATA TO BE COPIED FROM PRIMARY VOLUME AND STORE IN CACHE MEMORY — 603

COPY DATA STORED IN 603 TO ANOTHER LOCATION WITHIN THE CACHE MEMORY — 604

WRITE COPIED DATA TO SECONDARY VOLUME — 605

RESET INEQVALITY BITS — 609

ADVANCE COPY POINTER TO MATCH DATA COPIED TO THE SECONDARY VOLUME — 606

SAVE MODIFIED COPY POINTER — 607

Return
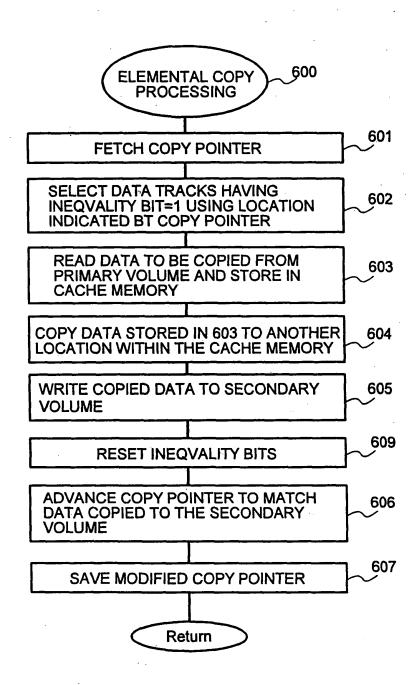
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FIG.7

701   702   703

| COMMAND CODE | PRIMARY VOLUME CODE | SECONDARY VOL. CODE |

700 COMMAND BLOCK

FIG.8

801

NO PAIR STATUS

211

CREATE PAIR COMMAND

212

DELETE PAIR COMMAND

802

PAIRED/ NOT COPED STATUS

DELETE PAIR CMD

212

214

RE-SYNCHRONIZE PAIR

804

PAIRED AND COPIED STATUS

CREATE COPY COMMAND

212

DELETE PAIR CMD

COPY PROCESSING COMPLETE

500

213

PAIRED/ COPY IN PROGRESS STATUS

803

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FIG.9

```
     ( PROCESSING CHANGE REQUEST )        900
     ( TO DATA ON PRIMARY VOLUME )
     ( DURING COPY PROCESSING )

     +-------------------------------+
     | SEARCH FOR PAIR INFORMATION   |      901
     | CORRESPONDING TO INPUT NUMBER |
     +-------------------------------+

            CHK PAIR      "PAIRED &              902
            STATUS OF  =  COPY IN        No
            ENTRY         PROCESS"
                ?

               Yes

            CHK IF INEQUALITY                    903
               BIT=1                     No
                ?

               Yes

     +-------------------------------+
     | READ DATA TO BE MODIFIED FROM |      904
     | PRIMARY VOLUME TO CACHE MEMORY|
     +-------------------------------+

     | COPY THE DATA IN THE CACHE MEMORY |   905

     | WRITE COPED DATA INTO SECONDARY   |   906
     | VOLUME                            |

     | RESET INEQVALITY BIT TO φ |           907

     | EXECUTE WRITE PROCESSING  |           909

               ( END )
```
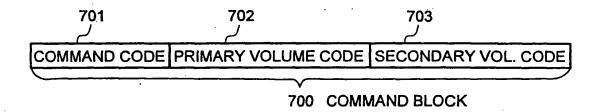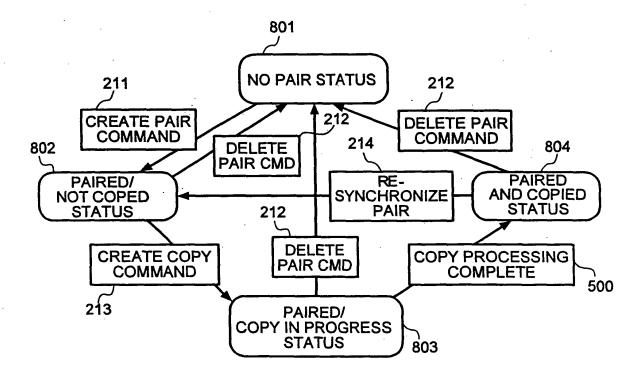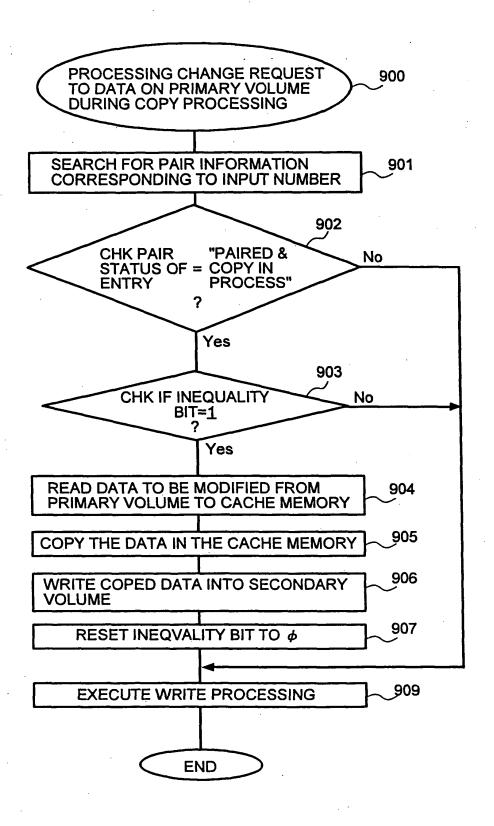
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FIG. 10A

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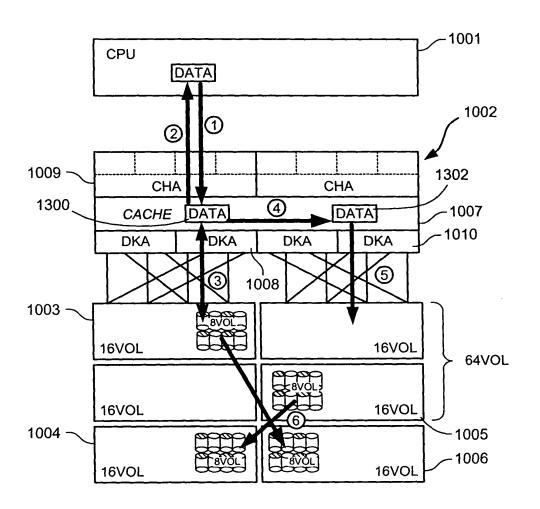Atty Docket No. 16869P-006210US
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Address Change Unit

1020

Buffer

1021

LA Exchange

② ③

1022

Cache

1022a 1022b

① ④

1024 1026

PDEV PDEV

Data Structure

1027 1029 1031

Data	LA	CD

DEV#

Check data for (Data + LA)

Data	LA	CD

Data Section: User Data
LA Section: Logical Address for Data Section (DEV#)
CD Section: Check Code

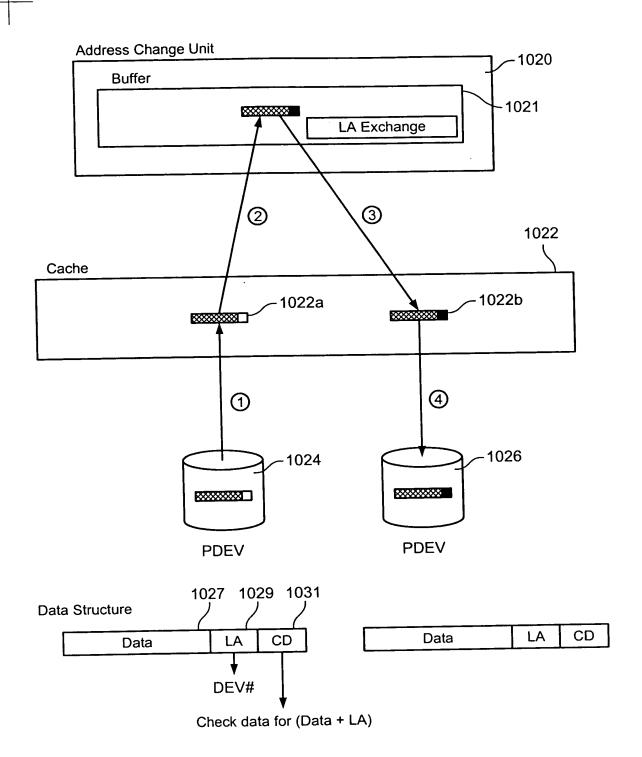FIG. 10B

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FIG. 11A

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1504

Volume List						
Port	S-Vol		Port	T-Vol		Pair
ID LWN	Vol#	Status	ID LUN	Vol#	Status	Status
1C:4:00	2:23	Normal	1E:F:00	2:2C	Normal	Duplex
1C:4:00	2:23	Normal	1E:F:01	2:2D	Normal	Duplex

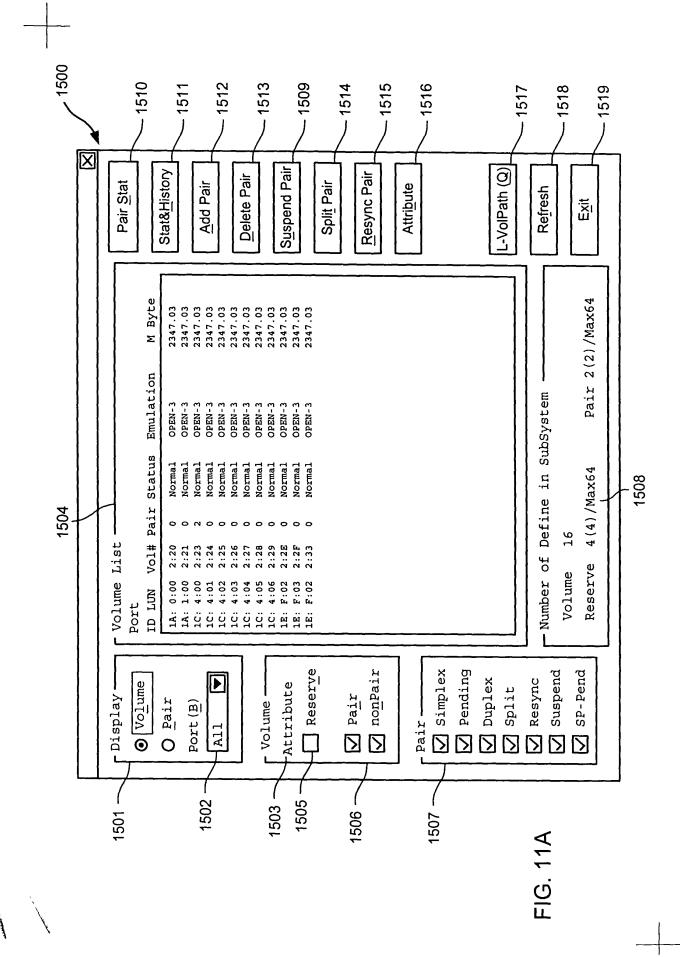FIG. 11B

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1520

1524

Add Pair Dialog

	Port		S-Vol			Port		T-Vol		
	ID LUN	Vol#	Status	Emulation		ID LUN	Vol#	Status	Emulation	
1C:4:00	**2:23**	**Normal**	**OPEN-3**				Auto		
1C:4:01	2:24	Normal	OPEN-3				Auto		
1C:4:02	2:25	Normal	OPEN-3				Auto		

1521

Copy Pace [Medium ▼] — 1523

Volume

	Port	ID LUN	Vol#	M Byte	Pair
S-Vol	1C:4:00	2:23	2347.03	1/Max:3

1522

T-Vol

Pair
 ⊙ Auto
 ○ Select

Volume
 ☑ Reserve
 ☑ not Reserve

Port (B)
 [All ▼]

		Port	T-Vol
	ID LUN	Vol#	Status	Emulation	M Byte
1A:0:00	2:20	Normal	OPEN-3	2347.03
1A:1:00	2:21	Normal	OPEN-3	2347.03
1C:4:03	2:26	Normal	OPEN-3	2347.03
1C:4:04	2:27	Normal	OPEN-3	2347.03
1C:4:05	2:28	Normal	OPEN-3	2347.03
1C:4:06	2:29	Normal	OPEN-3	2347.03

[Set]   [Change]   [Omit]   [Undo]   [Add]   [Exit]

1526   1525   1527   1528   1529   1530

FIG. 11C

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FIG. 11D

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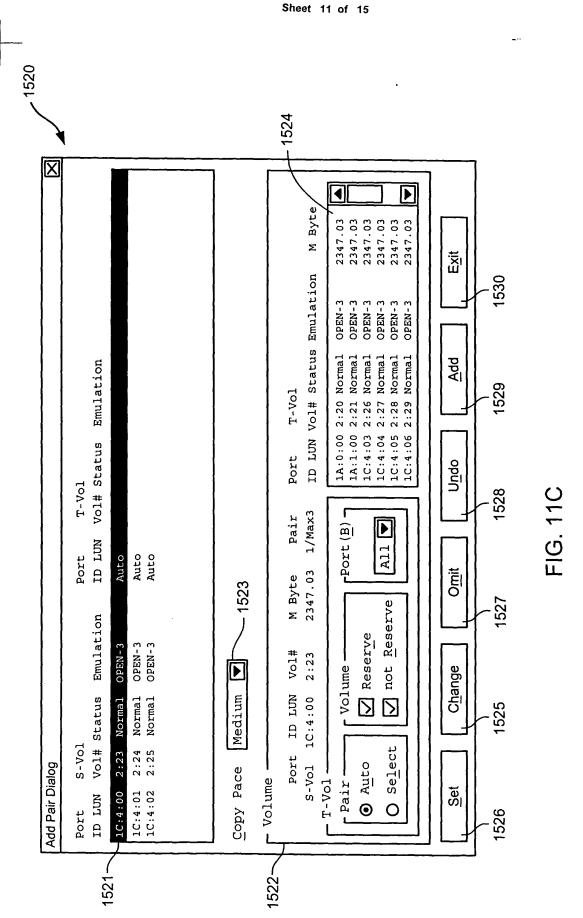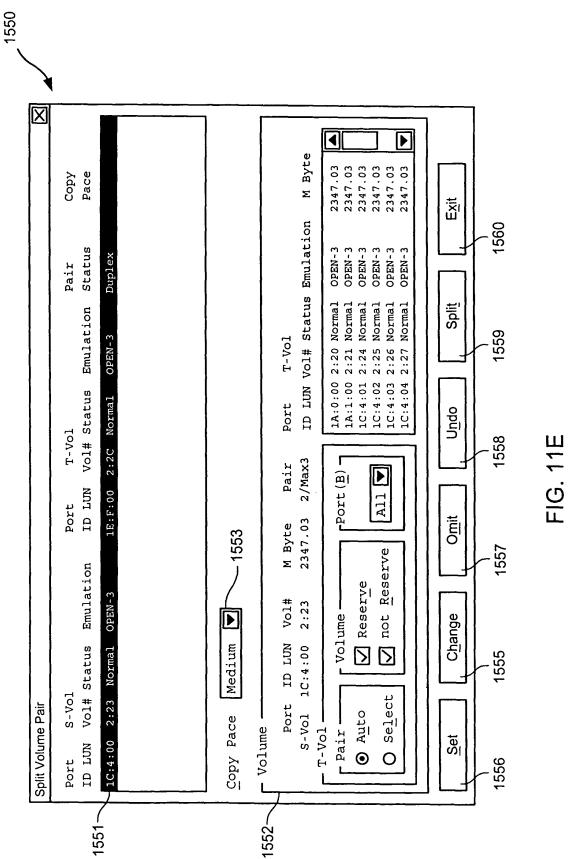Atty Docket No. 16869P-006210US
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1550

Split Volume Pair

Port	S-Vol				Port	T-Vol				Pair	Copy
ID LUN	Vol#	Status	Emulation		ID LUN	Vol#	Status	Emulation		Status	Pace
1C:4:00	2:23	Normal	OPEN-3		1E:F:00	2:2C	Normal	OPEN-3		Duplex	

Copy Pace [Medium ▶] — 1553

Volume

	Port	ID LUN	Vol#	M Byte	Pair
S-Vol		1C:4:00	2:23	2347.03	2/Max3

T-Vol

Pair
- ◉ Auto
- ○ Select

Volume
- ☑ Reserve
- ☑ not Reserve

Port (B) [All ▶]

Port	T-Vol				M Byte
ID LUN	Vol#	Status	Emulation		
1A:0:00	2:20	Normal	OPEN-3		2347.03
1A:1:00	2:21	Normal	OPEN-3		2347.03
1C:4:01	2:24	Normal	OPEN-3		2347.03
1C:4:02	2:25	Normal	OPEN-3		2347.03
1C:4:03	2:26	Normal	OPEN-3		2347.03
1C:4:04	2:27	Normal	OPEN-3		2347.03

[Set] 1556 [Change] 1555 [Omit] 1557 [Undo] 1558 [Split] 1559 [Exit] 1560

1551 1552

FIG. 11E

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1561

Resynchronize Volume Pair

Port	S-Vol				Port	T-Vol				Pair	Copy
ID LUN	Vol#	Status	Emulation		ID LUN	Vol#	Status	Emulation		Status	Pace
1C:4:00	2:23	Normal	OPEN-3		1E:F:00	2:2C	Normal	OPEN-3		Split	

1562

Copy Pace   Medium ▶
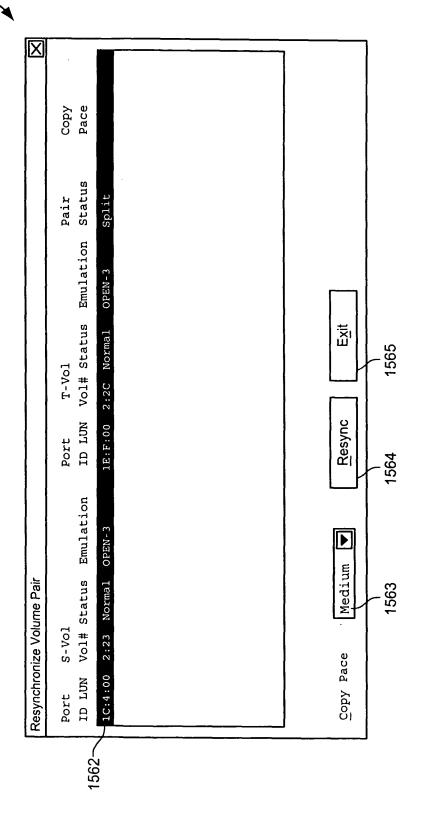
1563   1564   1565

        Resync   Exit

FIG. 11F

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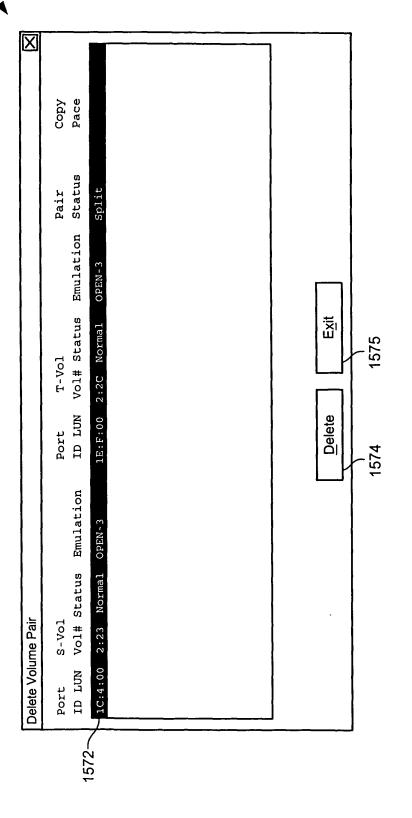**Delete Volume Pair**

Port	S-Vol			Port	T-Vol			Pair	Copy
ID LUN	Vol#	Status	Emulation	ID LUN	Vol#	Status	Emulation	Status	Pace
1C:4:00	2:23	Normal	OPEN-3	1E:F:00	2:2C	Normal	OPEN-3	Split	

1572

Delete   Exit

1574   1575

FIG. 11G